Volume 43 JULY, 1957 *Number 7*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

This Issue

LUBRICATION OF HIGHWAY CONSTRUCTION EQUIPMENT

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

Part of M-W & W's equipment task force that includes 29 scrapers and 20 dozers at work on 1.75-million-yard cut being made at a 30,000-yard-a-day rate. All equipment is 100% Texaco-lubricated and fueled.

"We're moving 30,000 yards a day – and that Texaco Plan certainly helps"

— says Project Manager Floyd Helm

Mr. Helm heads all field work for this joint venture of McCammon-Wunderlich Co. and Wunderlich Contracting Company. *The job:* construction of 4.9 miles of highway (relocated U.S. 40)—part of the approaches to new bridge across Carquinez Straits, California. All equipment is 100% Texaco-lubricated and fueled.

"Toughest part of this job," says Mr. Helm, "is a 1.75 million-yard cut. We're trying to keep blasting to a minimum and our rippers and scrapers really have a rough assignment. We're moving some 30,000 cubic yards per one-shift day and we couldn't do that if our equipment wasn't staying right on the job. That Texaco Simplified Lubrication Plan certainly helps. Our maintenance crew can handle all major lubrication with only six lubricants – no waste motion, no mistakes – and those Texaco Lubricants really stand up. We haven't had a single equipment failure due to lubrication."

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FOR ALL CONTRACTORS' EQUIPMENT

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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Vol. XLIII July, 1957 No. 7

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Lubrication of Highway Construction Equipment

BLAME it all on the Romans, who perhaps plagiarized the idea from the Babylonians! Hieroglyphics accredit the Babylonians for constructing pavements with asphalt, mineral filler and fibers around 3000 B.C. However, it was the Romans who first recognized the importance of good roads for providing comparatively quick transportation to the distant points of their continually expanding empire.

The construction procedure for the Appian Way built by the Romans (300 B.C.) adheres very closely to our current concept of good pavement construction. Apparently engineered in advance, the construction proceeded under the supervision of men provided with crude equipment to insure proper lines and grades. The road site was first manually excavated to a firm foundation by means of picks and shovels. The earth was carried away in baskets. Unsuitable base material was removed and replaced with firm subsoil which was thoroughly consolidated with a tamper. Wooden piles were driven into the subsoil where a firm foundation could not be obtained by excavation. Coarse sand was applied over the consolidated base to accommodate the undressed lower side of the stones used in the first course of masonry. This course consisted of two layers of stones held together with lime mortar prepared alongside the road. The thickness of this stone layer varied from 10 inches on good ground to 2 feet on bad ground. The second course, consisting of 9 inches of broken stone mixed with lime, served the purpose of leveling the roadbed. A third course constructed over the second consisted of approximately one foot of a cement mortar made of gravel and slaked lime which was built up in layers. This third layer had a 6 inch crown. A wearing surface (summa crusta) made of hard flint-like stones laid in the form of pentagons or hexagons capped the entire construction.

The over-all width of the Appian Way was approximately 36 feet and the thickness of the four courses varied from three to four and one-half feet. It was provided with curbs and milestones which showed the distance from Rome or the closest principal city. When consideration is given to the massiveness of its construction, it is not difficult to realize why the Appian Way endured for centuries. This road resembles our modern highways in many respects, but there is a vast difference in the method of construction when compared to our highly mechanized procedures used today.

Approximately 18 centuries passed before the desirability of having paved roads was realized, and then construction was limited primarily to city

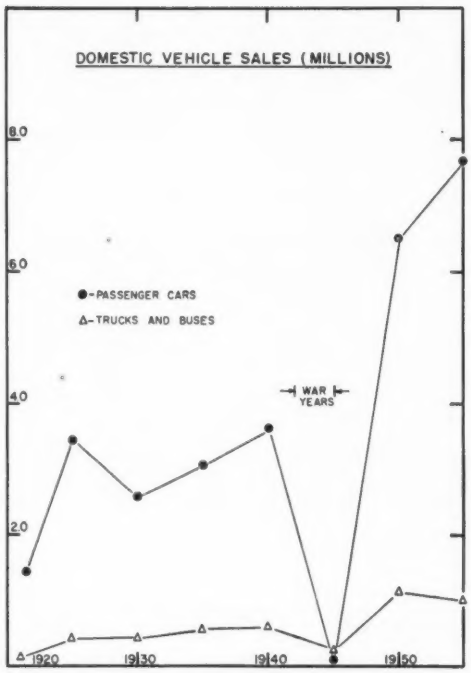


Figure 1 — Skyrocketing vehicle production necessitates more and better roads.

streets. It was the invention and immediate public acceptance of the automobile at the beginning of the century that formed the nuclei for better, wider and longer roads on which to travel. During the past 50 years, the automotive industry has been producing bigger and faster cars, trucks and buses at an ever increasing rate. Present production imposes a severe load on a highway system which was designed years ago to accommodate the existing traffic, but which is inadequate to handle the volume and loads of current highway users. The increase in vehicle production and travel are shown in Figures 1 and 2. One of the prime factors contributing to the inadequacy and failure of our older highways is the increasing number and weight of trucks which are playing an increasingly important role in the transportation of our industrial products and daily commodities. These are in addition to the 50,000,000 passenger cars in use today.

Characteristics of the Modern Highway

Our public officials and engineers who have the responsibility of designing new highways have benefitted immeasurably by detailed studies of road failures, traffic patterns and the causes of accidents under current conditions. Much progress has been made in soil mechanics, gradation and physical properties of aggregates, design of flexible and ridged pavements and operating variables which affect pavement life. As a result our new highways will provide faster, safer and more economical travel for a greatly increased number of vehicles. The original costs will be high but the maintenance costs should be at a minimum for several years. In contrast to many of our older highways, the new roads will be characterized by:

1. Sufficient pavement thickness to support the repetitive loads to which they will be subjected. In the case of express ways carrying large volume of heavy traffic, this will include the thickness and stability of sub-grade, sub-base, base and surface courses.

2. Increased road widths with multiple lane one-way traffic separated by median strips.

3. Relatively straight roads with large radius horizontal curves and minimum vertical curves which by-pass but have feeder roads to congested areas.

4. Smooth road surfaces with good skid and weather resistance.

The mileage of superhighways to be constructed during the next 15 years will be insignificant to that of our present primary and secondary road system. Considerable monies are being allocated for

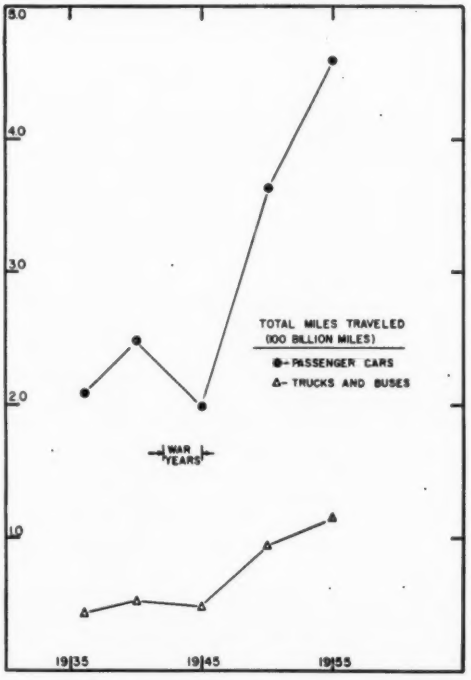


Figure 2 — Our present economy dictates greater use of our highways by cars, trucks and buses.

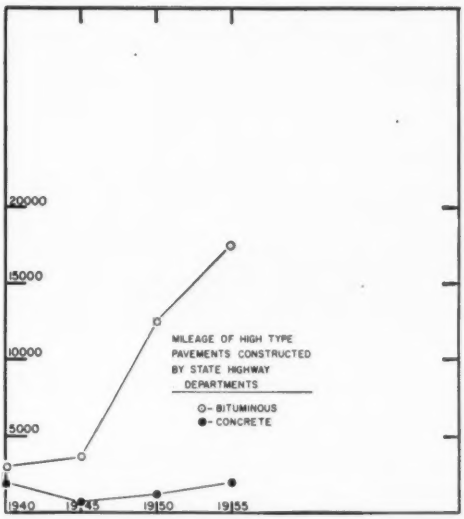


Figure 3 — State Highway Departments are striving to provide adequate mileage of economical roads.

the realignment and resurfacing of these older roads.

Modern Equipment — Bigger and Faster

Road building is big business today. While the highway system has not kept pace with the automotive production and use, this is not true for the manufacture of road building equipment. For the past 30 years, equipment manufacturers have built bigger and better designed units for each phase of road building. Many new pieces of equipment have been developed to permit the road builders to accomplish end results which investigations have disclosed as being necessary for optimum road service.

To describe, even sketchily, the recent developments in the equipment which make the current heavy construction operations possible would require volumes. Recent trends in equipment design are reflected in increase in engine horsepower, in speed, in unit load and capacity, in mobility and flexibility, in size and ruggedness, in ease of operation, and in features which make for more comfort and less strain on the operator. Full advantage is being taken of all the improvements that have been realized in the power units whether they be gasoline, diesel, or in some cases, LPG engines. Fully automatic or semi-automatic transmissions have been adopted by many equipment manufacturers. Refinements continue to be made in the design on the hydraulically, electrically, or mechanically operated attachments which permit easier and more efficient operation. Thus, on the whole, new equipment tends to be larger and more powerful which increases the unit work capacity; but at the same time it is faster, more mobile and much easier to handle, all of which increases overall operating efficiency.

Our current highly mechanized operating procedures are as far ahead of those used 40 years ago as the latter were ahead of the laborious hand procedures used in the construction of the Appian Way. Mechanization has introduced problems that the Romans did not have to consider. One of the more important of these is the lubrication and maintenance of equipment which is mandatory for trouble-free and economic operation.

Much of our modern equipment was developed as a result of modern design dictating much wider roads which are essentially straight and level so as to permit a greater traffic volume to travel faster and safer. Construction economics were a contributing factor to increased equipment size. The fact that expressways are no longer allowed to take the path of least resistance and wander circuitously across the country requires that hills be leveled, mountains tunneled and valleys filled.

Grading is becoming increasingly difficult since it is frequently necessary to remove an appreciable yardage of rock. This has resulted in the air compressor with its auxiliary drills and jack-hammers becoming essential additions to contractors' equipment. The lubrication responsibilities have increased simultaneously, since this equipment requires different lubricants than used in the heavier earth handling units. Another major equipment change has been the increasing use of Motor Graders or Earth Movers. These are tremendous self-propelled combination scrapers and dirt haulers capable of removing upward of twenty yards of dirt from a hill and distributing it in the low areas in a single operation. One of these units replaces a shovel and several trucks which were previously required for the same work.

Courtesy of LeTourneau-Westinghouse Company

Figure 4 — Huge dirt loaders and haulers replace steam shovels and trucks in many construction products.

Construction of the Modern Highway

The design of highways and the earth moving operations required to make the roadbed conform

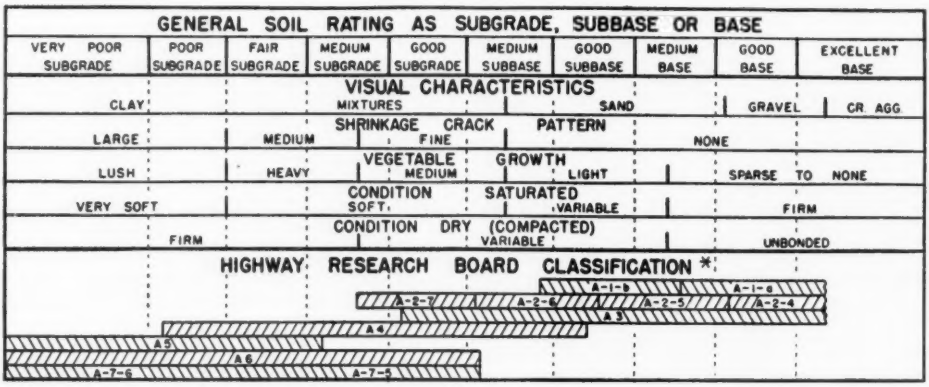


Figure 5 — Recognition of soil characteristics is essential in highway design.

to established grades are only two phases in the construction of a desirable road. Probably the greatest single advancement in the building of modern pavements is the development of the science of soil mechanics. Our greatly increased knowledge of soil properties is a natural result of exhaustive examinations of previous road failures which were attributed in many cases to inadequacies in the base material rather than to the overlaying surface courses. This was true of both rigid concrete and flexible asphalt pavements. It is well known that a clay soil may afford strong support when dry but lose practically all of its supporting value on becoming saturated with water. Through appropriate measurements, the behavior of soils under any particular set of conditions can be predicted within rather close limits. There are a number of methods of soil classification currently being used in conjunction with the pavement design. The Highway Research Board Classification is shown in Figure 5 in comparison to the general description of soils and their suitability for use in highway construction. This particular classification is based on such tests as Liquid Limit, Plastic Limit, Shrinkage Limit and Centrifuge Moisture Equivalent. The heavy repetitious truck loadings to which our present pavements are subjected exert considerable pressure to depths well below the wearing surface and early pavement failure is inevitable if the base and sub-base materials cannot support these loads under the most adverse conditions. This points to the necessity of eliminating any unsuitable soils from the underlying pavement courses.

It is not sufficient to be content with the procurement of good sub-base materials. The load supporting value is also dependent upon the degree to which these materials are compacted. This is recognized by all highway engineers, and construction specifications call for a high degree of compaction, based on the theoretical maximum density of the soil involved. Where appreciable depths of disturbed soils are to be compacted, as in the case of fills, compaction is carried out in incremental layers. This has resulted in the development of the "Sheepsfoot and Multiple Tired" rollers. These units vary in size and the compacting loads can be changed by adding or removing weights. They are designed for different scales of operations with the heavy duty units having gross weights of over one hundred tons. Their compacting efficiency is high due to high unit loading and the kneading action which they exert on the soil.

With the completion of the sub-base, the real heavy work of road construction is done but the job is only half finished. The sub-base must be protected with a more permanent flexible or rigid type pavement which functions to (1) prevent surface water penetrating the base, (2) protect the base from raveling and disintegration, and (3) provide a smooth riding and non-skid surface. These surface courses must have sufficient stability to resist defor-

Courtesy of Caterpillar Tractor Company

Figure 6 — The "Big Ones" move the dirt faster and cheaper.

Courtesy of Ingersoll-Rand

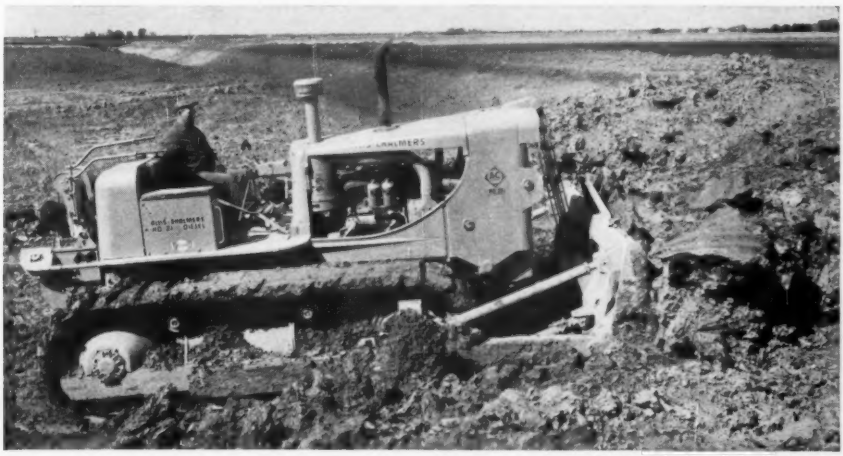
Figure 7 — Large and highly efficient rock drills are a necessity for the rock removal encountered in today's super-highway construction.

Courtesy of LeTourneau-Westinghouse Company

Figure 8 — Typical rock removal operation with shovel and hauler.

Courtesy of Euclid Division, General Motors Corporation

Figure 9 — Two engines are required to motivate this gigantic earth mover which levels hills in a short time.



Courtesy of Allis-Chalmers Mfg. Co.

Figure 10 — Diesel powered bulldozers level large areas quickly.

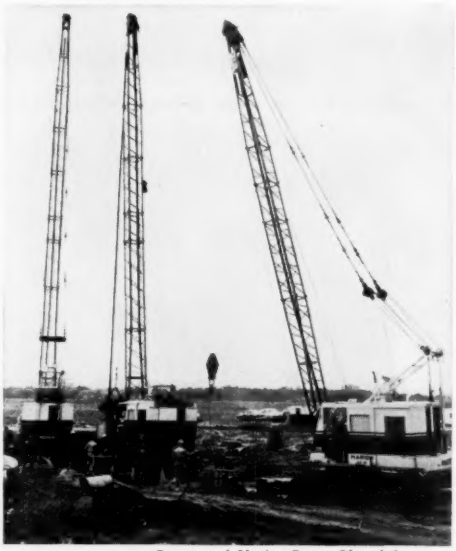
Courtesy of Ingersoll-Rand

Figure 11 — Air compressors and rock drills are playing an increasingly important role in our highway program.

mation by traffic and be capable of withstanding degradation by water, sun and freezing weather. Flexible asphalt or rigid concrete pavements are used for these surface courses. The former is being used most extensively today as a result of (1) greatly increased knowledge of base construction, and mixture design, (2) lower construction and maintenance costs and (3) riding qualities.

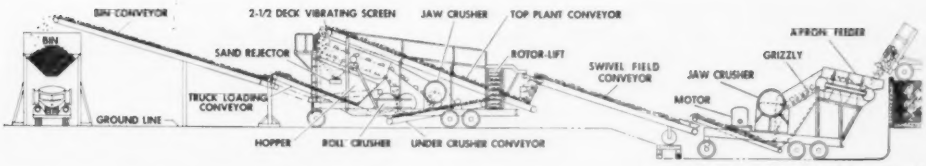
The accumulative research efforts of the many organizations interested in asphalt road construction has developed the basic causes of deficiencies in earlier construction and has provided recommendations for their elimination in today's construction. Very few people appreciate the complexity of an asphalt pavement and the controls which must be exercised during the mixing and laying operations to obtain the specified optimum results. The most important factors are the selection of suitable fine and coarse aggregates and their proportioning to obtain the maximum mix design stability. Stock piling procedures and equipment design minimize aggregate segregation which would result in variable properties of the finished mixture. The asphalt which cements the aggregate particles together is supplied against specifications which insure uniformity and satisfactory performance. The temperatures of the aggregate and asphalt are maintained at a minimum which will insure uniform distribution of the asphalt throughout the mixture in the shortest mixing time so as to not harden the asphalt. The equipment manufacturers have kept abreast of technical developments and our paving plants are supplied with qualities to insure uniform mixtures at high tonnage rate. While our current plants are basically the same as those used several years ago they have greater capacities, more efficient screens, better aggregate storage facilities, more accurate asphalt metering and better dust collecting systems.

Notable improvements have been made in the laying of the mixtures on the road. The hand operations of spreading and raking have been completely replaced by machines which lay the mixture continuously to any desired thickness and within extremely close tolerances. This guarantees a smooth riding surface after compaction which is essential for present high car speeds.



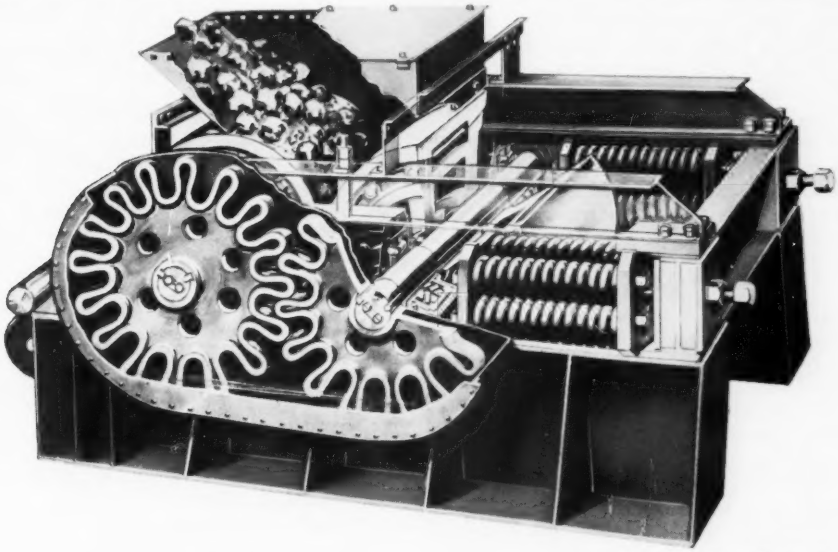
Courtesy of Marion Power Shovel Company

Figure 12 — Draglines do many jobs on bridges and overpasses demanded by current expressway design.



Courtesy of Diamond Iron Works

Figure 13 — Economical screening, crushing and loading of aggregates is a "must" in highway construction.



Courtesy of Pioneer Engineering

Figure 14 — Cutaway photograph of roll crusher showing heavy construction and lubrication of gears and bearings.

Courtesy of Iowa Manufacturing Company

Figure 15 — Portable screening and crushing plants lower paving costs by permitting use of local aggregates.

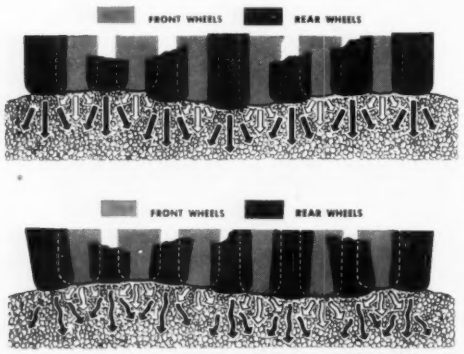
The fact that all but a small percentage of our present paved roads are made of asphalt is attributable to the versatile ability of asphalt to be used with most any type of available local aggregate which is an economic necessity. The wide adaptability of asphalt is due to its being available as semi solid asphalt cement, a wider range of liquid cutback asphalts and emulsified asphalts each of which is designed for use with specific types of aggregate available for road construction. The same types of equipment used for the super highways are used on the smaller road jobs but to a lesser extent. Many miles of asphalt gravel roads are made using only three pieces of equipment — a blade grader, asphalt distributor and roller. Most of the paved roads serving our rural areas are of this type and are maintained periodically with surface treatments employing distributors, spreaders and rollers. The multiple rubber tired rollers are rapidly replacing the steel rollers in this service.

LUBRICATION

Proper lubrication is vital to the successful and efficient operation of any piece of equipment. This is particularly true for today's modern machines with their increased speeds and loads and closer tolerances and clearances. However, there are certain factors peculiar to the construction industry which make lubrication an even more critical item.

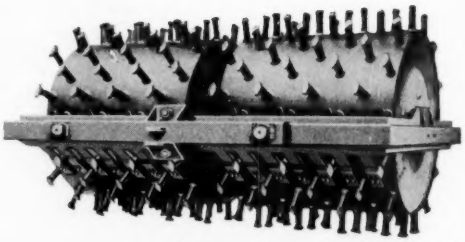
The speed with which a contractor completes a job is a big factor in determining whether he makes a profit or suffers a loss. Equipment must be kept in operation, if the job is to be finished on schedule or ahead of time. Machinery that must be taken off the job for repairs can be costly. Proper lubrication practices will go a long way toward keeping the equipment on the line.

Also, the environmental conditions under which construction equipment must operate are about the most adverse that can be found. Operation in dirt, mud, water and extremes of weather conditions is the rule rather than the exception. Thus, the problem of contamination is a very serious one. The importance of keeping contaminants away from precision bearings, gears and other moving parts of a piece of equipment cannot be emphasized too strongly. Modern construction machinery has been designed so as to seal out contaminants as much as possible. However, it is only through the application of good lubrication and preventive maintenance practices that the costly damage of contamination can be averted.



Courtesy of Wm. Bros. Boiler & Mfg. Co.

Figure 16 — Straight and wobble wheel multi-tired rollers produce uniform compaction and cover stone embedment on uneven surfaces.



Courtesy of Wm. Bros. Boiler & Mfg. Co.

Figure 17 — Diamond-shaped tampers designed for heaviest compaction jobs.

Efficient and economical operation of road building equipment can be realized by adhering strictly to the following rules.

1. Select quality lubricants
2. Store them properly
3. Dispense them carefully
4. Instigate a sound preventive maintenance program

Simplified Lubrication Plan

One of the problems comfronting a contractor is his choice of lubricants. On jobs where the number and variety of equipment are great, there is a tendency to stock more types of lubricants than may be necessary. For example, a survey of equipment on a small road job revealed that 21 different lubricants were being used, including five motor oils, four gear oils, three cable lubricants, six greases, a track roll lubricant, a cylinder oil, and a hydraulic oil. The use of such a large number of products presents a storage problem, and also invites the possibility of confusion and misapplication of lubricants.

After considerable study of the lubrication requirements of road building equipment, a simplified plan has been devised. Although the individual units used may vary considerably in design and function, they have many parts which are basically similar from the lubrication standpoint. Actual ex-

SIMPLIFIED LUBRICATION PLAN FOR ROAD CONSTRUCTION EQUIPMENT

Part Requiring Lubrication	*Lubrication Interval, Hours*	*Lubricant Type Used** 90-32°F.	32-10°F.
Engines – Gasoline, LPG and Diesel	100	Heavy Duty Engine Oil	
Engine Accessories – Oil Lubricated	100	SAE 30	SAE 20-20W
Oil can points – Moderate Loads	As required		
Gear Boxes – Transmissions, Differentials	1000		
Chain Drives	100	Extreme Pressure Gear Lubricant	
Flexible Couplings	1000		
Universal Joints	1000	SAE-140	SAE-90
Other Oil Lubricated Parts – Severe Loads	10		
Hydraulic Mechanisms (Except fluid transmissions)	1000		
Air Compressors – Reciprocating and Rotary	200	Premium Grade Hydraulic Oil SAE-30	SAE-10W
Electric Motors and Generators Oil Lubricated	1000		
Grease Fittings – Linkages, Plain Bearings, etc.	10	Multipurpose Heavy Duty Grease No. 2	
Ball and Roller Bearings	100		
Hand-Packed Bearings	100		
Wheel Bearings	1000		
Track Rollers	10	Track Roll Lubricant	
Exposed Gears	As required		
Railroad Traction Motor Gears	As required	Adhesive Type Gear Lubricant	
Wire Ropes and Cables	As required		

* Where standard SAE or NLGI viscosity and consistency specifications apply, they are shown for each temperature range. In other cases lubricant supplier should be consulted for proper grade.

perience on construction work, which has been confirmed by the Military, indicates that six basic types of lubricants can satisfy the requirements of nearly all construction machinery. These lubricants are identified in the chart along with the parts to be lubricated and the suggested interval between applications. The basic characteristics of these lubricants are described as follows.

Engine Oils

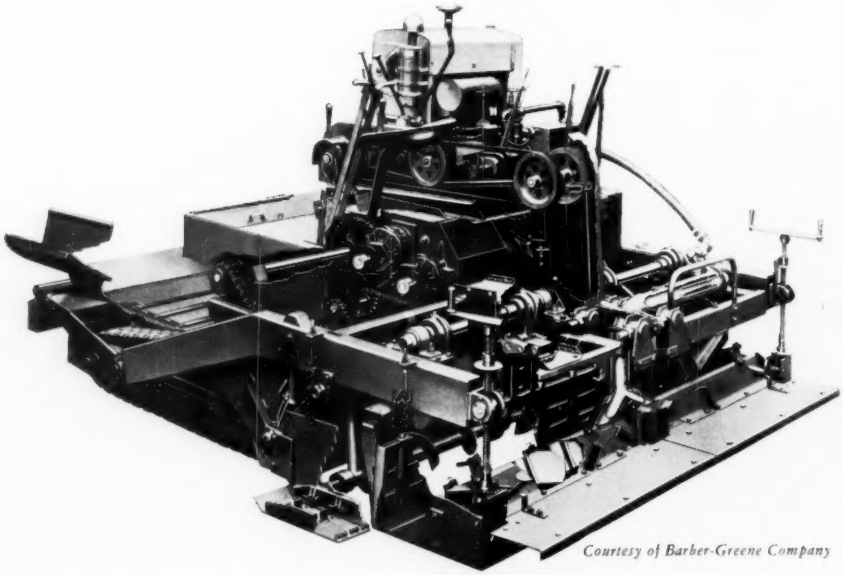
Gasoline and diesel engines powering road building equipment require a crankcase oil which will provide oxidation stability, corrosion resistance, extreme pressure and anti-wear properties, rust protection, foam prevention, and detergent-dispersant characteristics to hold combustion products in suspension. These properties have been built into the heavy duty type engine oils. Most of the engines in use are satisfied by an oil meeting Military Specification MIL-O-2104A. If an engine manufacturer specifies the need for an oil of higher detergency, such as "Supplement I," "Series 2" or "Series 3" oil, the oil supplier should be consulted and requested to provide a product meeting these requirements.

Gear Oils (EP Type)

Straight mineral oils can be used satisfactorily on certain gears, such as the ordinary spur or spiral-bevel type where rolling contact occurs between the gear teeth. However, where there is sliding contact between the gear faces, as in hypoid or worm gears, an oil with oiliness and extreme pressure properties is required to prevent scoring under heavy loads. Good gear oils of this type will absorb shock loads in the heaviest drives without losing their load carrying properties and will be resistant to oxidation, thickening, foaming, and corrosion. They will also provide some protection against misalignment. Consequently it is good practice to use them in all gear boxes.

Courtesy of E. D. Etynre & Company

Figure 18 — Large distributor units are capable of treating miles of road daily.



Courtesy of Barber-Greene Company

Figure 19 — Paving mixture spreaders have many moving parts that require proper lubricants to insure trouble-free operation.

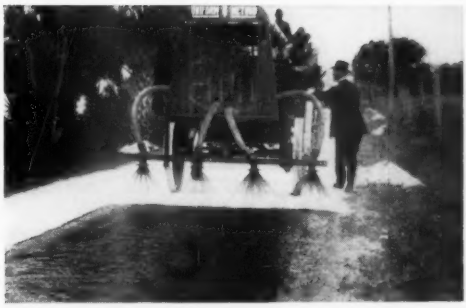
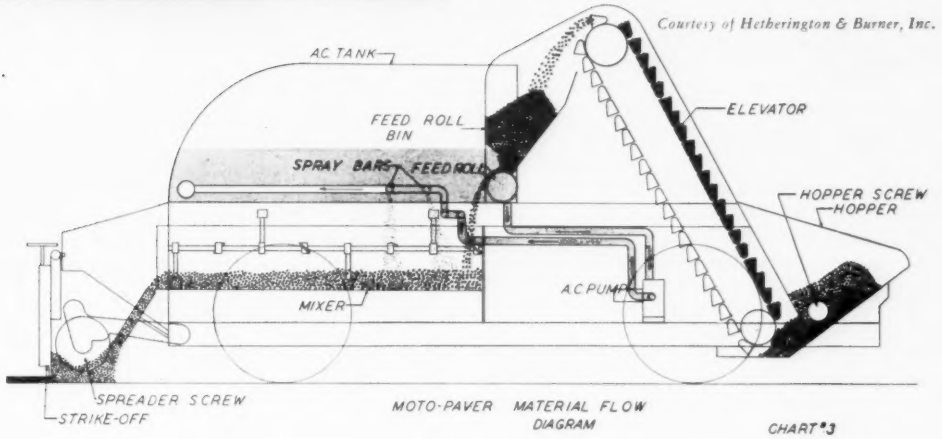
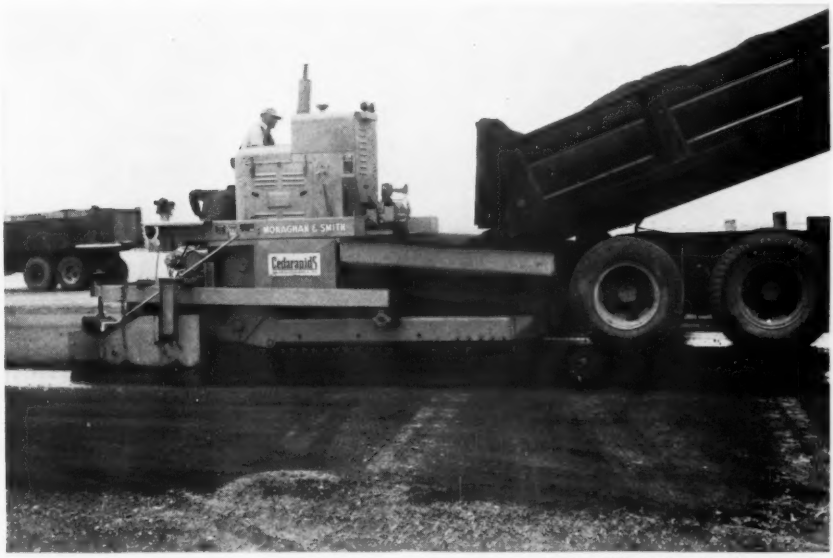


Figure 20 (Left) — 1915 Distributor Operation — We do it the same way today with much faster, more efficient equipment.

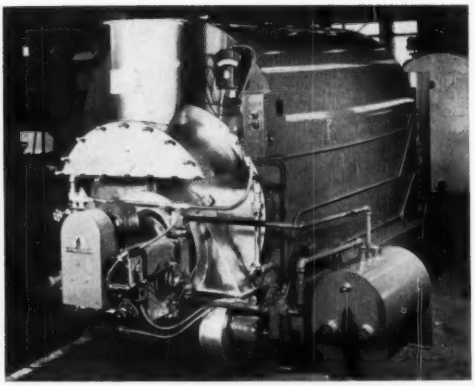
Figure 21 (Below) — Many miles of pavement are laid annually with continuous paving mixers.





Courtesy of Iowa Manufacturing Company

Figure 22 — Bituminous pavers apply paving mixtures with much greater speed and accuracy than manual method previously used.



Courtesy of Hy-way Machinery Incorporated

Figure 23 – Circulating hot oil heaters maintain asphaltic products at desired temperatures economically.

Gear Oils (Adhesive Type)

Open gears require a lubricant which will cushion shock loads, minimize noise and reduce wear. It must not channel or throw-off, but should cling to tooth surfaces even at high pressures, temperatures, and peripheral speeds. Lubricants satisfying these requirements are very adhesive and also contain special additives which impart unusually good resistance to water washing. Their fine penetrating and water resistant characteristics make them ideal as wire rope lubricants. They seal each strand in a tough, viscous film to reduce internal friction and wear, keep out moisture, prevent corrosion, and extend rope life.

Hydraulic Oils (Premium Grade)

In addition to acting as a physical medium for transmitting power, hydraulic oils lubricate pumps, cylinders, and other system components. Premium oils are fortified to prevent wear and rust and to resist oxidation, sludging and foaming.

Multi-Purpose Heavy Duty Greases

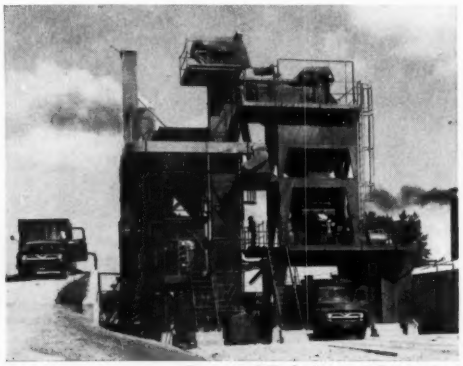
These are generally lithium base products with high dropping points. They should have an oil sufficiently heavy to withstand heavy wheel bearing loads. The grease must resist water contamination, resist shear breakdown, and have good low temperature pumpability. The term multi-purpose covers a great deal of territory. The integrity and reputation of the lubricant supplier are the best assurance the user has that a given grease meets all these stringent requirements. If there is any doubt that a given product can handle all the grease lubrication jobs shown in the table, it is best to use a separate grease for wheel bearing lubrication since this is the most critical requirement.

Track Roll Lubricants

Two types of product are available. One is a soft grease designed for use in track rollers using roller bearings and metal-to-metal seals. It needs to have good oxidation and mechanical stability. The other is a semi-fluid stringy compound which is used in lubricating the plain bearing type. It must flow out of the seals slightly thereby sealing against entry of dirt and water.

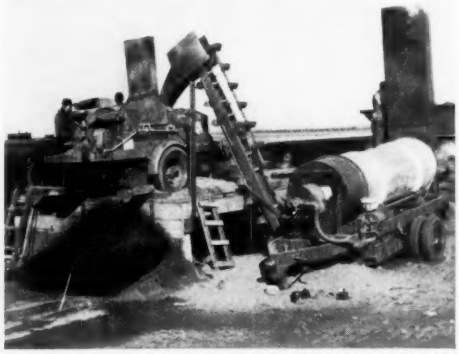
These, then, are the basic properties and characteristics of six types of lubricants which will satisfy most of the main lubrication requirements of road construction equipment. This simplified plan is flexible and can be modified and adjusted to meet any given situation. It should be regarded as a guide in assisting operators of construction equipment to reduce their inventory of different kinds of lubricants to a minimum with the assurance that their machines will be lubricated satisfactorily.

Although the recommendations outlined cover the vast majority of equipment, there may always be certain exceptions or conditions which will necessitate special lubricant recommendations. For example



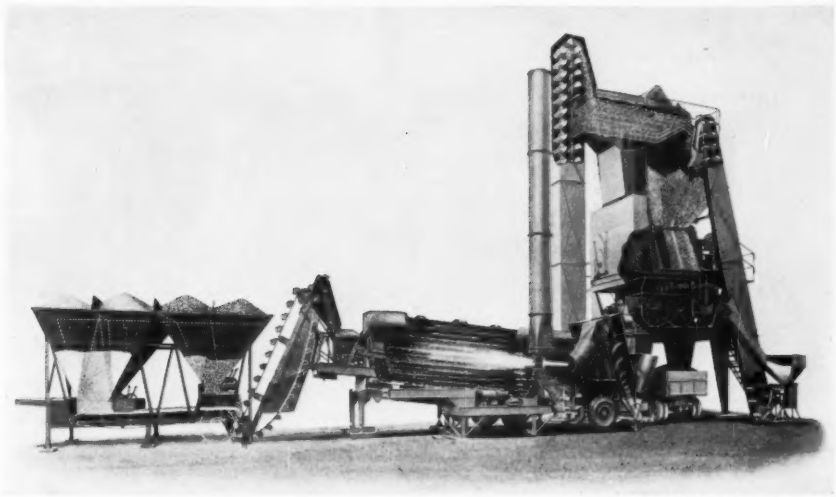
Courtesy of Hetherington & Berner, Inc.

Figure 24 – Modern Asphalt paving plants are efficient, clean and produce close to 200 tons per hour of paving mixture.



Courtesy of Littleford Bros., Inc.

Figure 25 – Portable mixing plants are efficient and provide economical mixtures for small construction and maintenance.



Courtesy of Barber-Greene Company

Figure 26 — Diagramatic photograph of batch asphalt plant showing aggregate segregation necessary for uniform operation and pavement stability.

special products may be required for such applications as water pumps (shaft seal type), fifth wheels, electric motors and generators (anti-friction), rock drills, steam cylinders, waste packed car journals, brake drum bearings on power shovels (severe service), concrete forms, and rust proofing of equipment in storage.

Also it is not advisable to make a general blanket recommendation for torque convertors and hydraulic couplings. Since there are wide variations in lubricant requirements for these components, product recommendations should be made on an individual basis.

Storage and Handling

The petroleum supplier takes every precaution necessary to assure that lubricants are in the best possible condition when delivered to the customer. The user, likewise, should exercise equal care to see that when a lubricant is applied, it is in the same good condition as when it was received.

Many things can happen to a lubricant between the time it is received by the customer and the moment it is applied. Such things as careless handling, contamination, confusion of brands, exposure to extreme temperatures, and leakage can result in damaged equipment, excessive maintenance cost, and lost productive effort. The conditions under which a contractor must store and handle lubricants are particularly hazardous from the standpoint of contamination and exposure to temperature extremes. Consequently, he should be unusually careful to see that nothing detrimental happens to them.

Some "do's and don'ts" that apply to storage and handling of lubricants are outlined as follows.

1. Choose storage area carefully. Select a central location so that hauling distances are as short as possible. Also select an area where the atmosphere is free from dust and vapors.

2. Store lubricants indoors if possible — chances of contamination will be less.

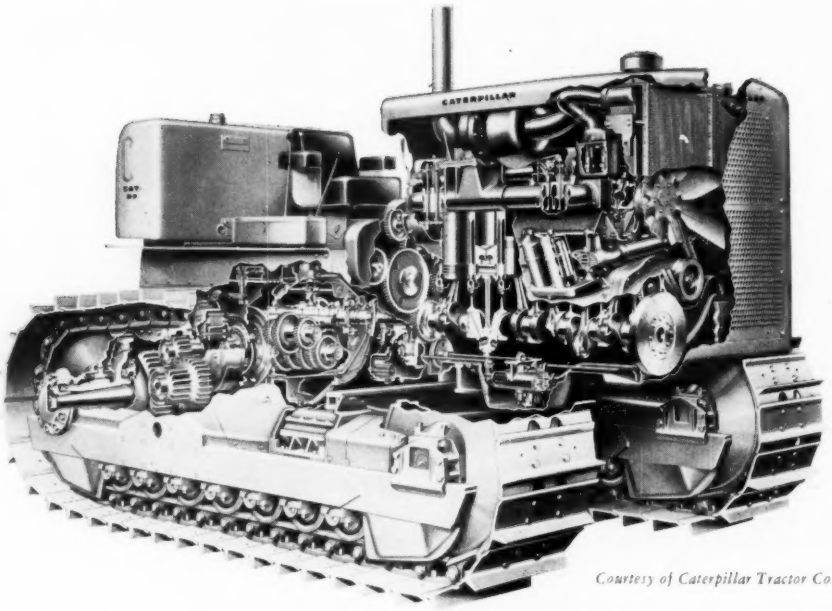
3. If stored outdoors, drums should be placed on their side and on racks — don't lay them on the ground. When placed upright on end, rain water may accumulate and be sucked into the drum by the normal breathing action. If stored outdoors on end even temporarily, cover should be available to place over drum in the event of inclement weather.

4. Cleanliness is essential regardless of whether storage is indoor or outdoor.

5. Orderliness is another must. By keeping different brands and types of lubricants separated and in their proper places, there is less chance for confusion and error.

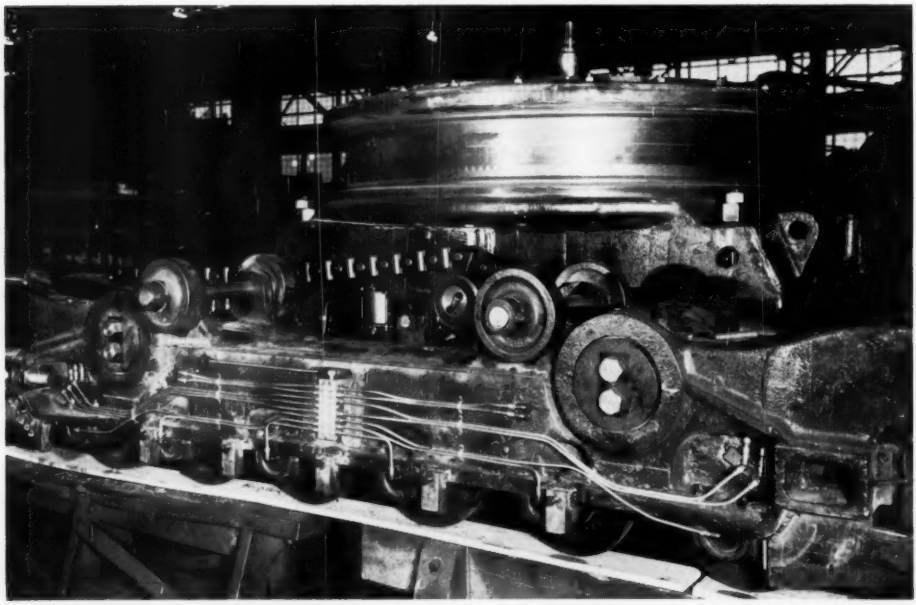
6. Don't store more products than necessary. The lubricant supplier will be glad to make a survey of lubrication requirements with a view to keeping the number of different products to a minimum. This also will reduce chances of confusion.

7. Exercise extreme care in heating products that have been exposed to low temperatures. If possible, transfer drums to a warm area and allow product to reach room temperature. If more rapid heating is required, use exhaust steam. Never apply direct heat, such as a flame, to exterior of the drum.



Courtesy of Caterpillar Tractor Co.

Figure 27 — Cutaway photograph of large tractor emphasizing the necessity of quality lubricants and good maintenance practices.



Courtesy of Bucyrus-Erie Company

Figure 28 — Centralized lubrication system on excavating equipment insures proper lubrication of all parts and minimizes maintenance.

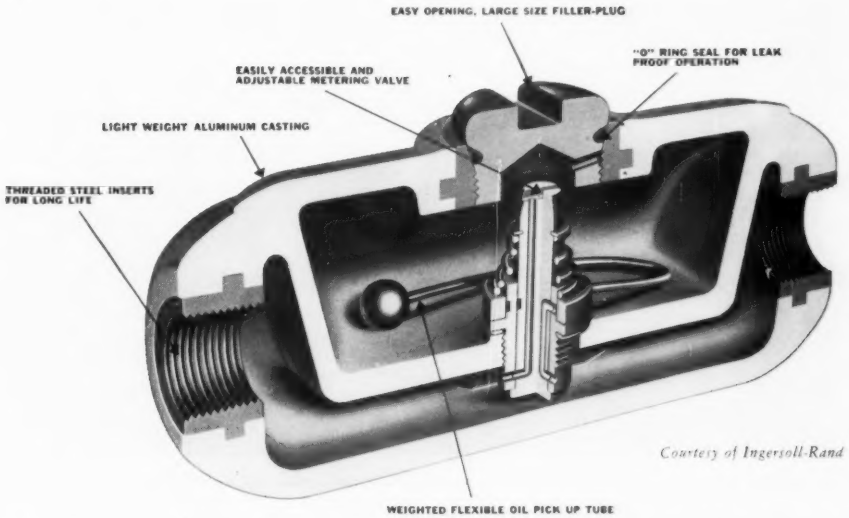

EASY OPENING, LARGE SIZE FILLER-PLUG
"O" RING SEAL FOR LEAK PROOF OPERATION
EASILY ACCESSIBLE AND ADJUSTABLE METERING VALVE
LIGHT WEIGHT ALUMINUM CASTING
THREADED STEEL INSERTS FOR LONG LIFE
Courtesy of Ingersoll-Rand
WEIGHTED FLEXIBLE OIL PICK UP TUBE

Figure 29 — Air-Line lubricator insures proper lubrication and high production from rock drills and air tools

This could melt the sealing compound and cause leaking. It might also harm the product.

8. Remember that exposure to temperature extremes can damage lubricants. If there is any reason to suspect that this condition has occurred, examine the lubricant before using. If the products appears abnormal, consult the lubricant supplier as to what to do. The lubricant may have to be discarded or it may be salvaged.

Application

On construction operations in particular, it is most advisable to apply the lubricant directly from the original container in which it came. The elimination of intermediate transfer receptacles erases a very serious source of contamination. Dispensing equipment is now available to fit all of the standard containers used to package lubricants and greases. They permit product to be removed from its original container with no danger of contamination, waste, or mess.

Preventive Maintenance

To the contractor striving to complete his job on time, equipment maintenance is (or should be) of prime importance. A piece of machinery which must be pulled off the job for repairs represents lost time. Also equipment not operating at top efficiency can have far reaching effects. For example, a sluggish push tractor may upset the smooth operation of an entire fleet of scrapers; the breakdown of a single haul unit may mean delays to a big loader; and the breakdown of a loader — even for a short time — may delay a long series of operations.

Although the lesson has been learned the hard way, experience has proven that in the long run it pays to take care of equipment on the job and not neglect it. A program of preventive maintenance, well planned and properly executed, will pay for itself over and over again. For example, it is much cheaper to keep a bearing adjusted than it is to buy new bearings, shafts, and gears that become damaged when unadjusted bearings fail. Major breakdowns, lost time, and high operating costs can be kept to a minimum by keeping parts lubricated, tightened, and adjusted. Furthermore, an operator whose equipment is always in good condition is very apt to be a happy, satisfied employee.

Since no two jobs are exactly identical, the actual details and execution of preventive maintenance programs will necessarily vary from job to job. However, there are a few basic concepts which are common and essential to all successful programs.

1. Set-up a definite schedule for lubrication and mechanical check-ups and *stick to it strictly*. Any program will begin to fall apart and become ineffective once exceptions are made and one starts to "cheat" on the original schedule. For example, if it is found that the interval between lubricant changes can be increased a certain amount with no apparent adverse effect, the natural tendency then is to extend it further and further. Such practice will inevitably lead to disaster.

2. If possible, have the preventive maintenance work performed on an off-shift, as this will cause a minimum of interference with the productive effort.

3. Assign men to this job who are familiar with

Figure 30 — These operating conditions demand good lubrication and maintenance practices.

lubricants and who are thoroughly acquainted with the equipment. The consequences are too great to entrust this work to uninformed personnel.

4. Keep accurate records of the servicing done on each piece of equipment. This need not be a complicated procedure. A few simple check marks on a printed form are all that is required. A study of such records will usually serve as a warning of possible trouble. For example, excessive oil consumption is evidence of poor lube fittings or oil leaks — items which can be checked at once by the mechanic. Also these records will indicate when the machine is nearing the overhaul stage.

5. Keep on hand a stock of parts and expendable supplies — if they are available when needed, equipment requiring new parts will be out of service for a minimum amount of time.

6. Clean equipment before servicing. On the face of it, this may seem ridiculous since the machines will become dirty again as soon as they are put back in service. However there are two good reasons for following this practice. First, the lubrication fittings will be uncovered, and the chances of any points being missed will be reduced. Fittings caked over with mud may be overlooked in accordance with the old adage "out of sight, out of mind." Second, there is less chance of dirt from the machine contaminating the lubricant at the moment of application.

These, then, are some points that should apply to any good preventive maintenance program. As mentioned earlier, the actual details of carrying out such a program must be worked out for each individual job. Usually, it is more difficult to set up an ideal program on short term jobs than on those that last for an extended period. As far as lubrication is concerned, the critical points are those which must be lubricated frequently and the critical time is at the start of the job.

SUMMARY

Investments in road building equipment and expenditures for highway projects are at an all time high and are expected to increase still further during the next few years. Highway contractors have over 330,000 units of equipment available for expanded highway programs, and public highway departments have more than 381,000 pieces of equipment ready to maintain and improve existing roads. The outlays for highway construction have increased by two billion dollars since 1952. Of the total sum spent on construction operations, twenty per cent is devoted to equipment maintenance but *less than one per cent is spent on lubricants.*

Quality lubricants have been developed which will more than protect moving parts under the severe conditions encountered in construction operations. Since the cost of good lubrication is almost negligible as compared to the value of the equipment, it should be evident that compromising with lubricant quality is false economy.

Operating costs can be reduced to a minimum and equipment life can be extended to the utmost by: (1) adopting a simplified lubrication plan which will keep the number of lubricants to a minimum; (2) storing and handling lubricants in accordance with accepted established practices; (3) applying lubricants properly; and (4) establishing a lubrication and preventive maintenance program and following it to the letter.

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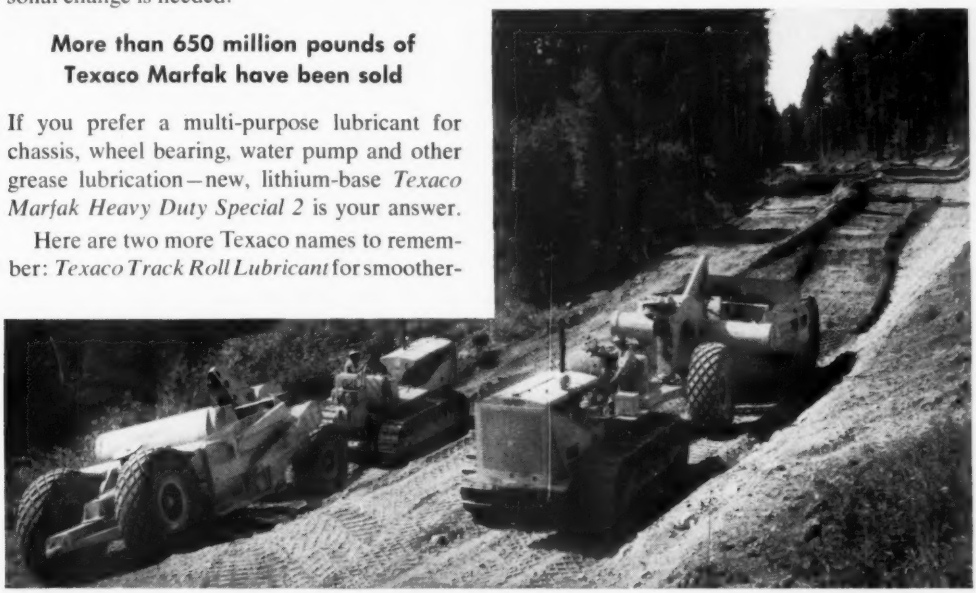

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